

CHELONIBIA IN THE NEOGENE OF FLORIDA

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THE present study is the second in a series on the late Tertiary and Pleistocene turtle-barnacles of Florida. The first paper (Ross, 1963b) considered the genus *Platylepas* Gray; the present report treats of the genus *Chelonibia* Leach. This study is based upon specimens obtained from the U.S. Geological Survey, the Florida State Museum collections at the University of Florida, and from the American Museum of Natural History, New York.

Chelonibia is represented in the Florida fossil fauna by two species, one variety, and one specimen of questionable identity. No new species are recorded. The collections here assembled contain 14 specimens ranging in age from late Miocene to Pleistocene. A discussion of the Recent species occurring in Florida waters was presented by Pilsbry (1916).

The specimens described and figured herein have been deposited in the Florida State Museum collections at the University of Florida (F.S.M.) and the United States National Museum (U.S.N.M.).

Order THORACICA Darwin, 1854

Family Balanidae Gray, 1825

Subfamily CHELONIBIINAE PILSBRY, 1916

Genus *Chelonibia* Leach, 1817

Chelonibia Leach, 1817, Jour. Phys. Chim. d'Hist. Nat., vol. 85, p. 68. Genus without originally designated type species; first species assigned to genus: *Chelonobia* [sic] *savignii* Leach [= *Chelonibia testudinaria* (Linnaeus), 1758]; therefore, *ipso facto* type species by subsequent monotypy (Leach, 1818, p. 171) and by subsequent designation of Pilsbry (1916, p. 263).

Chelonobia (error for *Chelonibia* Leach, 1817): Leach, 1818, Encyclopedia Britannica, suppl. to ed. 4-6, vol. 3, no. 1, p. 171 [see discussion of original spelling below].

Coronula: Lamarck, 1818, in part, Histoire naturelle des animaux sans vertèbres, vol. 5, p. 387, for *Coronula diadema* (Linnaeus), *Coronula balaenaris* (Gmelin), and *Coronula testudinaria* (Linnaeus) [reference to *Coronula testudinaria* only].

Coronula: Ranzani, 1818, in part, Opuscoli scientifici, vol. 2, pp. 85-86, for *Coronula testudinaria* (Linnaeus) and *Coronula patula* Ranzani [reference to species only]. (Republished in *Memorie di Storia Naturale*, 1820, pp. 50-51.)

Coronula: Say, 1822, in part, Jour. Acad. Nat. Sci. Philadelphia, vol. 2, p. 325, for *C[oronula] dentulata* Say [reference to species only].

Coronula: de Blainville, 1824, in part, Dict. Sci. Nat., vol. 32, pp. 379-380, for *Coronula bisexlobata* de Blainville, *C[oronula] testudinaria* (Linnaeus), *C[oronula] balanarum* [sic] (Spengler), *C[oronula] diadema* (Linnaeus), *C[oronula] tubicinella* (Lamarck), and *C[oronula] patula* Ranzani [reference to *Coronula testudinaria* and *Coronula patula* only]. (Republished in Manuel de malacologie et de conchyliologie, 1825, pp. 600-602.)

Astrolepas (ex Klein MS) Gray, 1825, Ann. Philos., new ser., vol. 10, no. 2, p. 105, for *A[strolepas] testudinaria* (Linnaeus), *A[strolepas] rotundarius* Gray, and *A[strolepas] laevis* Gray. Type species, here designated: *Astrolepas testudinaria* (Linnaeus) [= *Chelonibia testudinaria* (Linnaeus), 1758].

Asterolepas (error for *Astrolepas* Gray, 1825): Reichenbach, 1828, Zoologie oder Naturgeschichte Thierreichs, vol. 1, p. 89.

Chelonobium (error for *Chelonibia* Leach, 1817): Burmeister, 1834, Beiträge zur Naturgeschichte der Rankenfüsser, p. 5.

Chenolobium (error for *Chelonibia* Leach, 1817): Burmeister, 1834, Beiträge zur Naturgeschichte der Rankenfüsser, p. 8.

Coronula: Sowerby, 1839, in part, A conchological manual, p. 30, for *C[oronula] testudinaria* (Linnaeus), *C[oronula] balaenarum* (Spengler), and *C[oronula] diadema* (Linnaeus) [reference to *Coronula testudinaria* only].

Coronula: Chenu, 1843, in part, Illustrations conchyliologiques, unpaginated, pt. 3, pl. 1, pts. 18-19, pls. 2, 3, for *C[oronula] sulcata* Chenu, *Coronula diadema* (Linnaeus), *Coronula balaenaris* [sic] (Spengler), *Coronula testudinaria* [sic] (Linnaeus), and *Coronula californiensis* Chenu [reference to *Coronula sulcata* and *Coronula testudinaria* only].

Chenolobia (error for *Chelonibia* Leach, 1817): Rothpletz and Simonelli, 1890, Zeitschr. Deutsche Geol. Gesell., vol. 42, p. 724; Gruvel, 1902, Expéditions scientifiques du "Travailleur" et du "Talisman," p. 29.

Chetonobia (error for *Chelonibia* Leach, 1817): Tarasov and Zevina, 1957, Zool. Inst. Akad. Nauk S.S.S.R., p. 158.

Definition. Barnacles possessing an asymmetrical, hexamerous, thick shell and exhibiting incomplete concrescence of the rostrum and rostro-lateral compartments. The sutures of the composite rostral plate are clearly discernible internally, but externally only where the shell is worn. The parietes are porous, but may be secondarily filled, and they bear septa, the basal margins of which are serrate. The "sheath" occupies the complete internal surface of the shell, but growth ridges occur only on the upper one-third or less. Along the basal margin of the sheath of each compartment there are either sutural or medial and sutural semicircular channels. The basis is flat and membraneous. The elongated-oblong opercular valves do not completely fill the orifice. The scutum and tergum are articulated by a strong chitinous ligament.

The labrum has a median notch on each side of which there is a long row of teeth. The III, IV, V, and VI pair of cirri are remarkably long. Cirri IV, V, and VI consist of numerous short segments, each segment having two pairs of long spines and little tufts of shorter spines between the longer ones.

Distribution and Habitat. *Chelonibia* has a world-wide distribution in tropical and warm temperate seas. Recent representatives of this genus have been reported from the Hawaiian Islands, Galapagos Archipelago, western and eastern Mexico, United States, Yucatan, Honduras, Cuba, Jamaica, Puerto Rico, St. Thomas, Venezuela, Brazil, Gambia, Congo, Mediterranean Sea, India, Viet Nam, Ceylon, Australia, and the Japanese Archipelago.

Manatees (*Trichechus*), turtles (*Caretta*, *Thalassochelys*, *Eretmochelys*), brachyuran crabs (*Callinectes*, *Portunus*, *Menippe*), horseshoe crabs (*Limulus*), and gastropods (*Busycon*) serve as substrata for this group.

Remarks. The species of *Chelonibia* form perhaps one of the better taxonomically known groups although, unfortunately, nothing is known about the general biology of these barnacles. At the present time seven species, one subspecies, and three varieties are recognized.

The earliest probable reference to a turtle-barnacle is by Ulyssis Aldrovandi (1606). This species (*C. testudinaria*), ranging stratigraphically from middle or upper Miocene to Recent (Withers, 1953), however, is credited to Linnaeus (1758). *Chelonibia caretta*, described by Spengler (1790; type locality unknown), is reported only from lower Miocene deposits of Pemba Island, Zanzibar Protectorate (Withers, 1928). The third species referred to this group, *C. patula*, was described by Ranzani (1818) from Recent specimens occurring in the Adriatic Sea. *Chelonibia patula* has been cited in the fossil record of Europe and is here reported from the late Miocene of Florida. *Chelonibia patula dentata* Henry is a contemporary west Mexican form of this species. *Chelonibia manati* Gruvel (1903), from the Congo, is known only from Recent specimens. Pilsbry (1916) described two varieties of this species, *crenatabasis* and *lobatabasis*; the latter from Florida waters, the former from an unknown locality. The remaining three species referred to this genus are based solely on late Tertiary specimens: *C. capellinii* de Alessandri (1906) from the middle Miocene (Helvetian) and Pliocene (Astian) of Italy, *C. hemisphaerica* Rothpletz and

Simonelli (1891) from the Pliocene of Grand Canary, and *C. depressa* Seguenza (1876) from the Pliocene (Astian) of Sicily.

Many taxonomists have failed to note the correct spelling of the generic name. The original orthography is *Chelonibia* (Leach, 1817) where as in a later paper by the same author (Leach, 1818) it is *Chelonobia*, the difference being merely a change in the connecting vowel. There is no evidence from the original publication of an inadvertent error, and furthermore, the original spelling does not contravene any mandatory articles of the International Code of Zoological Nomenclature. Therefore, the original spelling is here adopted unequivocally. No attempt was made to ferret out and list in the above generic synonymy all of the misspelled citations of *Chelonibia* inasmuch as they would fill several pages.

Since Linnaeus first described *C. testudinaria*, type species of the genus *Chelonibia*, no subsequent worker has redescribed or figured the type specimens. It appears questionable that Darwin ever saw any of the Linnean cirriped types because no mention of them is found in any of his monographs. Darwin does, however, acknowledge several conversations with Sylvanus Hanley concerning the Linnean cirriped collections. Hanley, the first taxonomist to review the Linnean collections, stated (1855, p. 18), "The very bad condition of the majority of the Cirripedes in the Linnean cabinet, and the absence of appended numerals to the specimens, prevent much aid being derived from an examination of the types."

Recently, Dodge (1952) reviewed the barnacles described by Linnaeus and stated (p. 24), "The specimens in the collection are in bad condition and bear no identifying names or numbers," thus reaffirming Hanley's earlier observations. Mr. S. P. Dance of the British Museum (Natural History) has informed the author that "A specimen, labelled by Hanley, *Lepas testudinaria*, is included [in the Linnean Society of London collections] but is devoid of any markings or of any other evidence proving it to be Linnean" (letter of January 9, 1963).

It is well known that Linnaeus marked a name or a number on each shell described from his collections, corresponding to their position in either the 10th or 12th edition of the "Systema." Smaller shells were placed in tin boxes and the boxes likewise marked in his own hand. The question now arising is whether the sole specimen of *C. testudinaria* in the Linnean Society of Lon-

don collections is the one described personally by Linnaeus or one placed there by someone else prior to Hanley's study. The dubious source of the Linnean barnacles that Hanley examined may be the reason why Darwin and subsequent workers have neither mentioned nor figured *C. testudinaria*.

Aurivillius (1894) briefly described the specimens identified by Linnaeus in the "Museum Ludovicae Ulricaе" catalogue (Linnaeus, 1764), but as Dodge (1952) and earlier workers have indicated, none of the species described in this work, which are now housed at the University of Upsala, Stockholm, bear the probative notations of Linnaeus.

The criteria used by Hanley, Dodge, and other taxonomists for positive identification of Linnean specimens has been the aforementioned markings and specimen containers. Inasmuch as these workers, as well as Mr. S. P. Dance, indicated that the isolated specimen of *C. testudinaria* is devoid of these markings, it is the author's opinion that this specimen is not the holotype. Designation of a neotype is currently being undertaken by the writer.

Chelonibia patula (Ranzani), 1818

Figs. 1 *a-d*

Coronula patula Ranzani, 1818, Opuscoli scientifici, vol. 2, p. 86, pl. 3, figs. 25-28, Recent, Adriatic Sea.

Chelonibia patula; Withers, 1929, Ann. Mag. Nat. Hist., ser. 10, vol. 4, p. 569, pl. 11, figs. 8-12, lower Miocene, Péloua, France; upper Miocene, Kalksburg, Austria.

Chelonibia patula; Withers, 1953, Catalogue of fossil Cirripedia in the Department of Geology, vol. 3, Tertiary, pp. 57, 58, 61, 62, 69, 75, lower Miocene, France; middle Miocene, Italy; Pliocene, Italy; upper Miocene, Austria.

This species is represented in the present collections by two specimens, one of which is a left lateral or carino-lateral compartment. The second specimen is a portion (right rostro-lateral compartment) of the composite rostrum. No significant differences can be noted between these and Recent specimens, and thus no light is shed on the phylogeny of this group.

Chelonibia patula is easily identified by the light fragile shell, thin outer lamina, and relatively few and thin longitudinal septa. The interseptal spaces, which are not secondarily filled, extend to

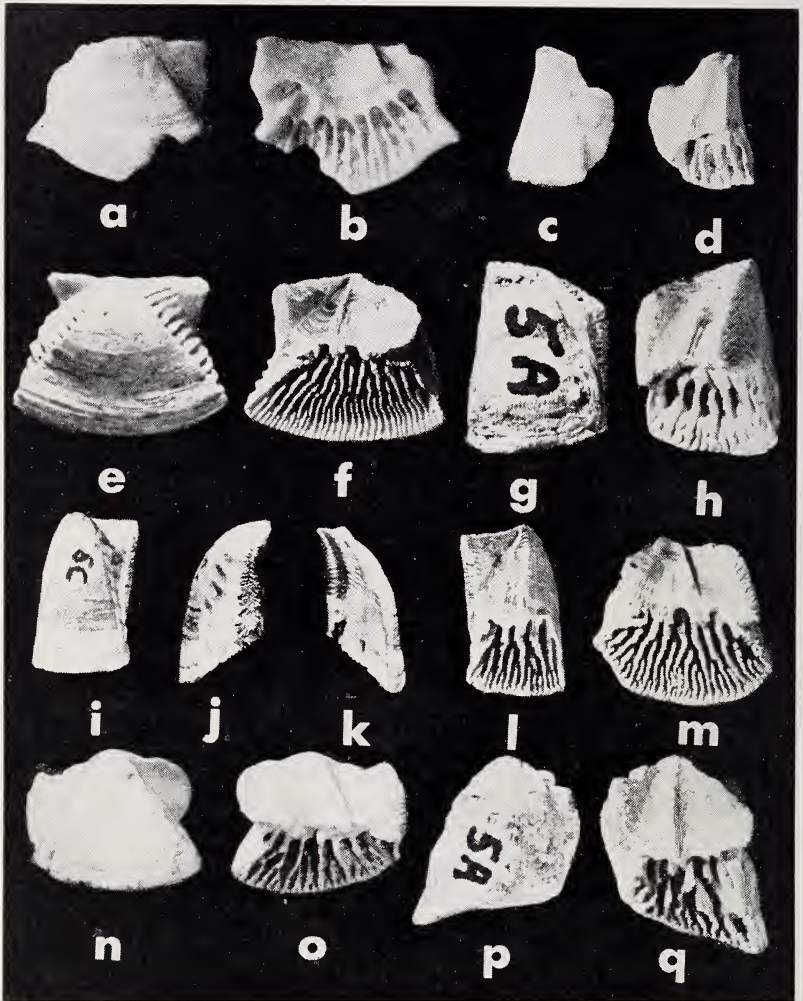


Fig. 1. *Chelonibia patula*: a, b, external and internal views of left lateral or carino-lateral, F.S.M. No. 1320; c, d, external and internal views of right rostralateral, F.S.M. No. 1321. *Chelonibia testudinaria*: e, f, external and internal views of right lateral or carino-lateral, U.S.N.M. No. 648509; g, h, external and internal views of right rostro-lateral, F.S.M. No. 1322; i, j, k, l, external, radial, alar and internal views of right rostro-lateral, F.S.M. No. 1323; m, internal view of left lateral or carino-lateral, F.S.M. No. 1324; n, o, external and internal views of left lateral or carino-lateral, F.S.M. No. 1325; p, q, external and internal views of right lateral or carino-lateral, F.S.M. No. 1326. All figures approximately X2.

the apex of the parietes. The basal margin of the sheath has only one broad medial arch.

The sutural face denticulation of the rostro-lateral compartment, where articulating with the rostrum, consists of numerous, parallel, downward-opening V-shaped ridges, the inner arm of which is the shortest. The same denticulation occurs on Recent specimens of this species.

Chelonibia caretta, which has not been found in the Florida fauna, may be distinguished from this species and *C. testudinaria* by the absence of interseptal cavities, sutural channels or arches only, and parietal septa which are not continuous from the periphery to the sheath, but are divided into moderately short, separate portions or merely points.

Locality and Horizon. State Road Department borrow pit (N.E. $\frac{1}{4}$ S.E. $\frac{1}{4}$ sec. 24, T. 38 S., R. 24 E., Arcadia Quadrangle) along Florida Highway 760, approximately 1.6 miles east of the junction of U.S. Highway 17 and Florida Highway 760 at Nocatee, De Soto County, Florida, Tamiami formation, late Miocene, Arnold Ross collector, September, 1959.

Chelonibia testudinaria (Linnaeus), 1758

Figs. 1e-q, 2a-g

Lepas testudinaria Linnaeus, 1758, *Systema naturae* . . . , 10th ed., p. 668, Recent, type locality unknown.

Chelonobia [sic] *testudinaria*; de Alessandri, 1906, *Paleont. Italica*, vol. 12, p. 314, pl. 18, figs. 6a-b, 7a-b, Pliocene, Orciano (Toscana), Italy.

Chelonibia testudinaria; Withers, 1953, *Catalogue of fossil Cirripedia in the Department of Geology*, vol. 3, Tertiary, pp. 62, 75, Pliocene, Italy; middle or upper Miocene, Cuba.

Chelonibia testudinaria; Ross, 1963a, *The Compass*, vol. 40, no. 4, p. 229, Pleistocene, Florida.

Chelonibia testudinaria; Ross, 1963b, *Quart. Jour. Florida Acad. Sci.*, vol. 26, no. 2, p. 156, Pleistocene, Florida.

Ten specimens in the collections are assigned to this species. Three of these are portions (two right rostro-lateral and one left rostro-lateral compartment) of the incompletely fused rostral plate. The remaining specimens here represented are a carina, four right and two left lateral or carino-lateral compartments.

This species is distinguished from other *Chelonibia* by the thick and strong parietes with teeth or notches on both sides of each suture. It should be noted here that some specimens do not

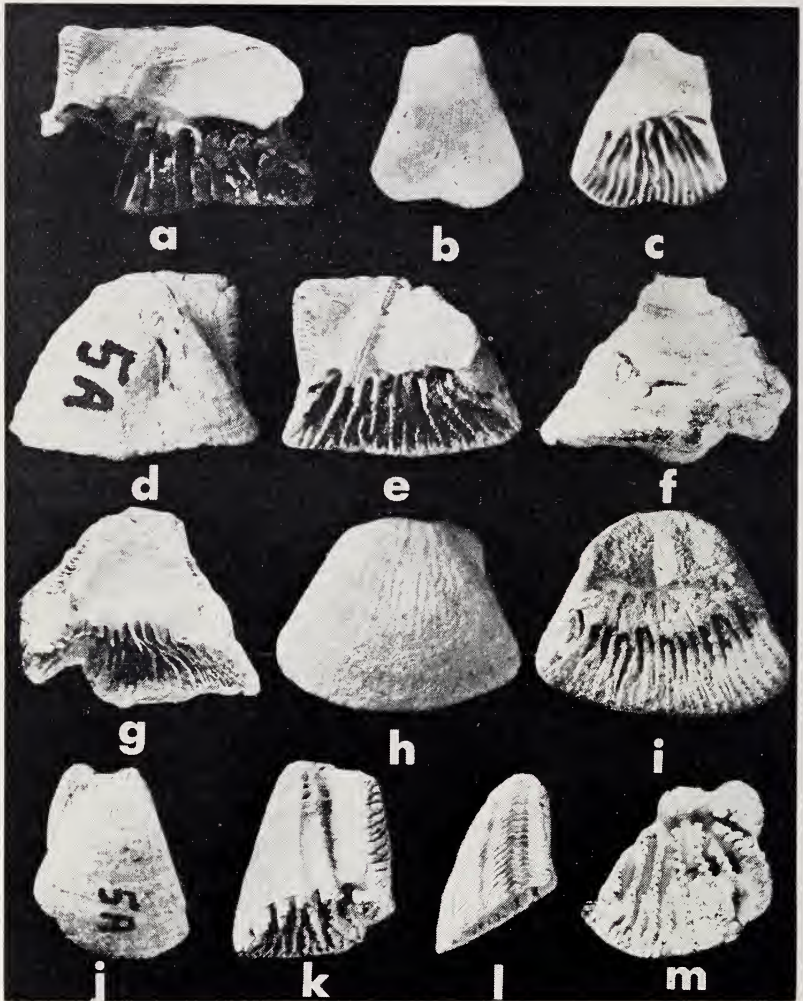


Fig. 2. *Chelonibia testudinaria*: a, internal view of right lateral or carino-lateral, U.S.N.M. No. 648510; b, c, external and internal views of left rostro-lateral, U.S.N.M. No. 648511; d, e, external and internal views of right lateral or carino-lateral, F.S.M. No. 1327; f, g, external and internal views of carina, F.S.M. No. 1328. *Chelonibia* sp.: h, i, external and internal views of right lateral or carino-lateral, F.S.M. No. 1329. *Chelonibia testudinaria* cf. *C. testudinaria* var. *solida*: j, k, l, m, external, internal, alar and basal views of left rostro-lateral, F.S.M. No. 1330. All figures approximately X2.

possess these teeth or notches, and identification must therefore be based upon the longitudinal septa and the number of channels in the basal margin of the sheath. The numerous longitudinal septa extend from the outer lamina inward, alternately, to a varying degree, i.e., there may be primary septa which span the complete basal margin, secondary, extending two-thirds the distance, tertiary, extending one-third or less the distance, and marginal, the shortest septa along the periphery. The interseptal spaces penetrate about two-thirds or less the height of the shell. The basal margin of the sheath possesses both sutural and medial channels. The sutural dentition of the rostro-lateral and rostral compartments of this species is similar to that of *C. patula*. The only significant difference is that instead of there being one inverted "V" there are several connected crests and troughs extending the width of the sutural face.

Locality and Horizon. Drainage ditch on Florida Highway 20 and 100, about 6 miles west of Bunnell, Flagler County, Florida, Pamlico formation, Pleistocene, J. E. Lewis collector, March, 1958.

Spoil banks next to Canal C-23 (U.S. Geological Survey Cenozoic locality 22846), St. Lucie County, Florida (sec. 24, T. 37 S., R. 37 E., Okeechobee 4 N.E. Quadrangle), about 2.4 miles north of the Florida East Coast Railroad, Pamlico formation, Pleistocene, Druid and Ethel Wilson collectors.

Spoil banks adjacent to Rim Ditch Canal (U.S. Geological Survey Cenozoic locality 22805), St. Lucie County, Florida (N.E. $\frac{1}{4}$ sec. 29, T. 36 S., R. 39 E., Fort Pierce S.W. Quadrangle), on the southwest side of the canal, approximately 175 yards northwest of the Florida East Coast Railroad and about 2 miles southeast of the intersection, at bridge 27, of Shinn Road and Rim Ditch Canal (Shinn Road crosses U.S. Highway 70 about 11 miles southwest of Fort Pierce), St. Lucie County, Pamlico formation, Pleistocene, Druid and Ethel Wilson collectors, December, 1960.

Spoil banks of canals and north bank of North Fork (of Alligator Creek), west of U.S. Highway 41 (U.S. Geological Survey Cenozoic locality 22454), at Sea Lanes subdivision, Punta Gorda, Charlotte County, Florida (N.E. $\frac{1}{4}$ and N.W. $\frac{1}{4}$ N.W. $\frac{1}{4}$, sec. 20, R. 23 E., T. 41 S., Punta Gorda Quadrangle), Caloosahatchee formation, Pleistocene, Druid and Ethel Wilson collectors, December, 1960.

Chelonibia sp.Figs. 2*h-i*

One specimen, a right lateral or rostro-lateral compartment is too poorly preserved to permit specific identification. The external ornamentation, where not obliterated, consists of equidistantly spaced, moderately broad, convex riblets. The elongated cavities between the longitudinal septa are, apparently, secondarily filled, except for a narrow zone approximately midway between the outer and inner surfaces. These cavities extend upward about two-thirds the distance toward the apex of the compartment.

This specimen appears to be an intermediate stage between *C. testudinaria* (*sensu stricto*) and the following variety.

Locality and Horizon. Spoil banks adjacent to Harvey Pond Canal, near intersection of Florida Highways 78 and S 721, Glades County, Florida. Caloosahatchee formation, Pleistocene, William K. Emerson collector, August, 1960.

Chelonibia testudinaria cf. *C. testudinaria*var. *solida* Withers, 1929Figs. 2*j-m*

Chelonibia testudinaria var. *solida* Withers, 1929, Ann. Mag. Nat. Hist., ser. 10, vol. 4, p. 568, pl. 11, figs. 5-7, lower Miocene, Lorient, France.

Chelonibia testudinaria var. *solida*; Withers, 1953, Catalogue of fossil Cirripedia in the Department of Geology, vol. 3, Tertiary, p. 57, lower Miocene, France.

The variety *solida* was characterized by Withers (1929) as having ribbed walls, the interseptal spaces secondarily filled, and both sides of the parietes lacking notches or teeth. One compartment in the present collections, a left rostro-lateral, agrees with the diagnosis of this variety with two exceptions. The interseptal spaces on the radial side are not totally filled whereas those on the opposite side are. Secondly, there is some intimation of very poorly developed external parietal teeth.

In the author's opinion the varietal term *solida* is not worthy of recognition since preliminary studies on Recent specimens of *C. testudinaria* (*sensu stricto*) indicate that there is a variable degree of secondary interseptal filling, and development of parietal teeth or notches. The author cannot, unfortunately, presently provide

ample justification for synonymizing this variety owing to the lack of sufficient fossil material.

Location and Horizon. Drainage ditch on Florida Highway 20 and 100, about 6 miles west of Bunnell, Flagler County, Florida, Pamlico formation, Pleistocene, J. E. Lewis collector, March, 1958.

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